

Option 1: Surface Discharge (No Action)

				Notes
Option Specifications				
Estimated flow per well	gpm	12		1
Estimated flow	gpm			
Estimated flow	gpd			
Estimated flow	bpd			
Rip-rap	c.y.	10		2
Piping per well	ft	1320		2
Piping required	ft			
Trench depth	ft	6		3
Trench width	ft	3		2
Excavation volume	c.y.			
Outfall Structure	unit	1		
Land required	acres			4
Costs				
Cost of limestone rock (rip-rap)	\$/c.y.	32.4		5
Piping cost - installed	\$/ft	20		9
Outfall Structure	\$/unit	\$2,000		17
Land acquisition	\$/acre	400		1
Subtotal Direct Costs				
Site preparation	5	% of subtotal direct cost		7
Total Direct Cost				
Insurance	1.5	% of total direct cost		8
Contingency	5	% of total direct cost		8
Total Indirect Cost				
Total Capital Cost				
Annual Operating and Maintenance Costs				
Labor hours	man yrs	0.1		2
Labor cost	\$/yr	\$40,000		9
Total Annual Costs				

Option 2 & 3: Discharge with Treatment

				Notes
Option Specifications				
Estimated peak flow per well	gpm	60		
Estimated average flow per well	gpm	12		1
Estimated average flow	gpm			
Estimated average flow	gpd			
Estimated average flow	bpd			
Piping per well	ft	1320		2
Piping required	ft			
Trench depth	ft	6		3
Trench width	ft	3		2
Excavation volume	c.y.			
Land required	acres			10
Tank storage capacity	hrs	1		
Max Influent tank size	gal			
Max Effluent tank size	gal			
Building size required	sq.ft.			11
Costs				
Piping cost	\$/ft	20		9
Land acquisition	\$/acre	400		1
Influent tank	\$			12
Effluent tank	\$			12
RO System	\$			13
Equipment building	\$/sq.ft.	32.64		6
Land acquisition	\$/acre	400		1
Subtotal Direct Costs				
Equipment cost markup	5	% of subtotal direct cost		7
Site preparation	5	% of subtotal direct cost		7
Electrical systems	15	% of subtotal direct cost		7
Startup and testing	2	% of subtotal direct cost		7
Total Direct Cost				
Insurance	1.5	% of total direct cost		8
Contingency	5	% of total direct cost		8
Total Indirect Cost				
Total Cost				
Annual Operating and Maintenance Costs				
Labor	man yrs	0.5		2
Labor cost	\$/yr	40,000		9
Horsepower required for RO	hp	75		
Electrical costs	\$/kwh	0.044		14
Membrane cleaning	\$/1000 gal	0.011		15
Membrane replacement	\$/1000 gal	0.05275		15
Total Annual Costs				

DRAFT Option 4: Storage Ponds

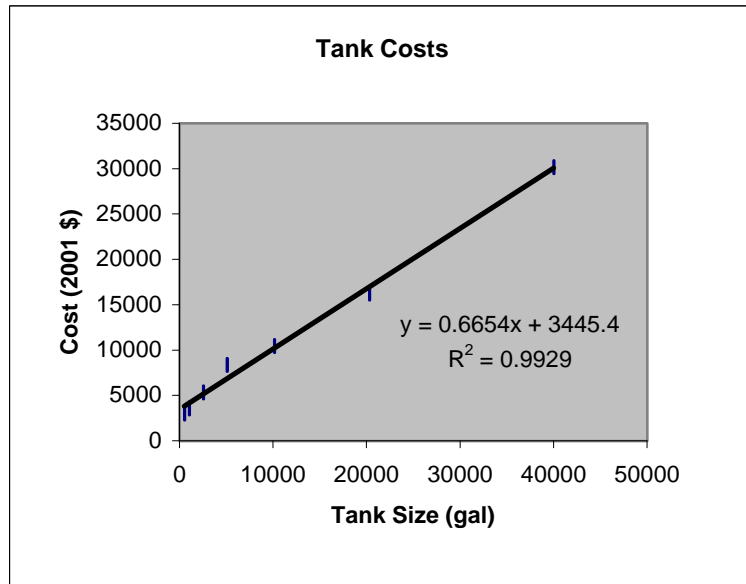
				Notes
Option Specifications				
Maximum Estimated Flow	gpm	60		1
Estimated flow	gpm			
Estimated flow	gpd			
Estimated flow	bpd			
Piping per well	ft	1320		2
Piping required	ft			
Trench depth	ft	6		3
Trench width	ft	3		2
Trench excavation volume	c.y.			
Required storage period	days	180		2
Estimated pond volume	ft ³			16
Evaporation	ft/yr	4		1
Infiltration	ft/yr	4		1
Actual depth of pond	feet	16		2
Design depth (includes infiltration/evap)	feet	24.00		
Slope of pond sides (horizontal: 1ft verti	feet	3		
Guess width/length	feet			16
Calculated volume	ft ³			16
Depth added for 25-yr, 24-hr storm	in	3		
Adjusted volume	ft ³			16
Pond size	acre-ft			16
Pond size	c.y.			16
Land required (pond surface area + tren	acres			16
Rip-rap	c.y.	10		2
Costs				
Piping	\$/s.f.	20		9
Excavation cost, pond	\$/c.y.	0.99		5
Mobilization cost	\$	194		5
Rip rap	\$/c.y.	32.4		5
Land acquisition	\$/acre	400		1
Subtotal Direct Costs				
Site preparation	5	% of subtotal direct cost		7
Total Direct Cost				
Insurance	1.5	% of total direct cost		8
Contingency	5	% of total direct cost		8
Total Indirect Cost				
Total Cost				
Annual Operating and Maintenance Costs				
Labor hours	man yrs	0.1		2
Labor cost	\$/yr	\$40,000		9
Total Annual Costs				

DRAFT Option 5: Reinjection

			Notes
Option Specifications			
Estimated flow per well	gpm	12	1
Estimated flow	gpm		
Estimated flow	gpd		
Estimated flow	bpd		
Piping per well	ft	2640	2
Piping required	ft		
Trench depth	ft	6	3
Trench width	ft	3	2
Excavation volume	c.y.		
Land required	acres		10
Well depth	2500		
Reinjection well capacity	gpm/well	0-250	
Wells required			
Storage time for tank	hrs	1	
Feed tank	gal		
Building size required	sq.ft.		11
Costs			
Piping cost	\$/ft	20	9
Land acquisition	\$/acre	400	1
Reinjection well costs	\$	188000	19
Tank costs	\$		12
Pump costs	\$		18
Equipment building	\$/sq.ft.	32.64	6
Land acquisition	\$/acre	400	1
Subtotal Direct Costs			
Equipment cost markup	5	% of subtotal direct cos	7
Site preparation	5	% of subtotal direct cos	7
Electrical systems	15	% of subtotal direct cos	7
Startup and testing	2	% of subtotal direct cos	7
Total Direct Cost			
Insurance	1.5	% of total direct cost	8
Contingency	5	% of total direct cost	8
Total Indirect Cost			
Total Cost			
Annual Operating and Maintenance Costs			
Labor	man yrs	0.5	2
Labor cost	\$/yr	40,000	9
Electricity required	KWh	480	
Electrical costs	\$/kwh	0.044	20
Total Annual Costs			

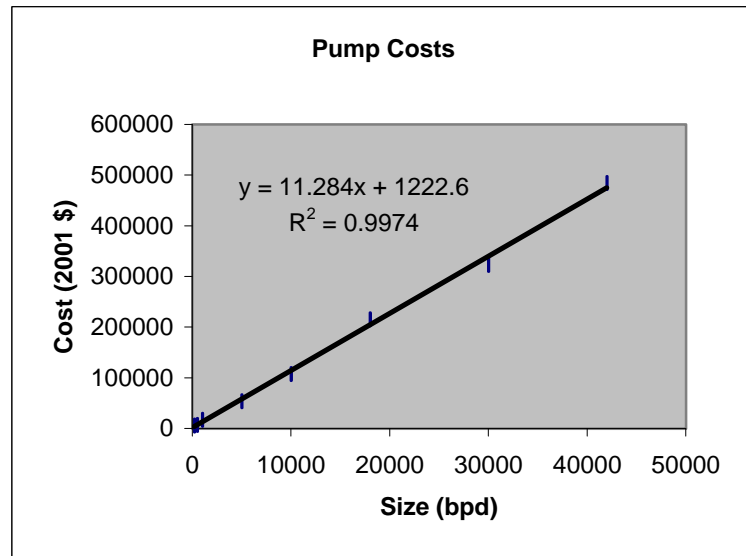
Tank costs from Plas-Tanks

Size	1997 Cost	2001 Cost
529	2793	3015.846
1028	3285	3547.101
2540	4920	5312.553
5074	7743	8360.793
10147	9664	10435.06
20293	15041	16241.08
40000	27949	30178.97



Pumps

Size (bpd)	1995 Cost	2001 Cost
200	5158	5838.703
500	5912	6692.208
1000	15259	17272.73
5000	47543	53817.26
10000	95086	107634.5
18000	190172	215269
30000	285258	322903.6
42000	427887	484355.4



- 1 Information obtained from operators (Coalbed Methane Operators Information Survey Results, September 2001) and phone calls.
- 2 Best professional judgement (BPJ) assumption.
- 3 A 6 foot depth was assumed based on the maximum depth of frost penetration.
- 4 The amount of land required was computed as the area disturbed during trenching.
- 5 Costs obtained from RSMeans Site Work and Landscape Cost Data, 20th Edition 2001.
- 6 Costs obtained from Bni Building News Mechanical/Electrical Costbook, 2001. Costs adjusted to Sheridan, Wyoming.
- 7 Percentage obtained from General Electric Corporation, DCN 15900 in EPA docket W-99-23.
Percentage is based on Brown and Caldwell estimate and is based on historical data, MEANS, and other cost references.
- 8 Cost factors obtained from RSMeans Building Construction Cost Data, 59th Edition, 2001.
- 9 Costs obtained from CDM Camp Dresser & McKee Petroleum Association of Wyoming
Coal Bed Methane Producers, *Technical Support for Antidegradation Review for*
- 10 The amount of land required was computed as the area disturbed during trenching plus
one additional acre for the an equipment building.
- 11 From requirement list from US Filter price quote.
- 12 Costs obtained from Plas-Tanks Industries, Inc for fiberglass-reinforced plastic tanks. Updated to 2001 costs.
- 13 Costs obtained from US Filter.
- 14 Costs obtained from the Department of Energy Energy Information Administration.
- 15 Costs obtained from a US Filter proposal for a RO/Continuous Deionization system.
- 16 See pond calculation sheets. Ponds are assumed to be square with sloped sides.
- 17 E-mail correspondence with Duane Zavadil 10/04/01.
- 18 Costs taken from *Development Document for the Coastal Subcategory of the Oil and Gas Extraction Point Source Category*.
- 19 Costs obtained from Caribou Land & Livestock Montana, LLC.
- 20 Based on information from Wiemers Engineering LLC.